Re-evaluation Decision RVD2010-06

Quintozene

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Re-evaluation Decision

After a re-evaluation of the fungicide quintozene, Health Canada's Pest Management Regulatory Agency (PMRA), under the authority of the *Pest Control Products Act* (PCPA) and Regulations, is granting continued registration of certain uses while requiring a phase-out of other uses of quintozene products for sale and use in Canada.

Products containing quintozene used on cole crops and for ornamental bulb dip treatments do not pose unacceptable risk to human health or the environment, and have an agricultural value when used according to the label directions. All other uses of quintozene are being phased-out due to the health and/or environmental concerns. They include all turf and ornamental (except bulb dip treatment) uses. As a condition of continued registration for the ornamental bulb dip and cole crop uses, additional data are required under Section 12 of the PCPA.

The re-evaluation of quintozene was first presented in the Proposed Re-evaluation Decision document PRVD2009-02, *Quintozene*[1]. This Re-evaluation Decision document[2] describes this stage of PMRA's regulatory process for the re-evaluation of quintozene and summarizes the Agency's decision as well as the reasons for it.

Comments received during the consultation process were taken into consideration. Appendix I summarizes the comments received during the consultation period and provides PMRA's response to these comments.

In addition, recent analytical data were requested by the PMRA on Track 1 contaminants levels in the quintozene technical product. This information is also discussed in Appendix I.

This decision is consistent with the proposed re-evaluation decision stated in PRVD2009-02. To comply with this decision, registrants of products containing quintozene will be informed of the specific requirements affecting their product registration(s) and of regulatory options available to them.

What Does Health Canada Consider When Making a Re-evaluation Decision?

The PMRA's pesticide re-evaluation program considers potential risks, as well as value, of pesticide products to ensure they meet modern standards established to protect human health and the environment. Regulatory Directive DIR2001-03, *PMRA Re-evaluation Program*, presents the details of the re-evaluation activities and program structure.

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1 "Consultation statement" as required by subsection 28(2) of the *Pest Control Products Act*.

2 "Decision statement" as required by subsection 28(5) of the *Pest Control Products Act*.

Quintozene, one of the active ingredients in the current re-evaluation cycle, has been re-evaluated under Re-evaluation Program 1. This program relies as much as possible on foreign reviews, typically United States Environmental Protection Agency (USEPA) Reregistration Eligibility Decision (RED) documents. For products to be re-evaluated under Program 1, the foreign review must meet the following conditions:

- it covers the main science areas, such as human health and the environment, that are necessary for Canadian regulatory decisions;
- it addresses the active ingredient and the main formulation types registered in Canada; and
- it is relevant to registered Canadian uses.

Based on the outcome of foreign reviews and a review of the chemistry of Canadian products, the PMRA has made a regulatory decision and requires appropriate risk-reduction measures for Canadian uses of quintozene. In this decision, the PMRA took into account the Canadian use pattern and other issues (for example, the federal Toxic Substances Management Policy [TSMP]).

The USEPA re-evaluated quintozene and published its conclusions in a 2006 RED.

For more details on the information presented in this Re-evaluation Decision, please refer to the Science Evaluation in the related Proposed Re-evaluation Decision PRVD2009-02, *Quintozene*.

What Is Quintozene?

Quintozene is a fungicide that is currently used to control fungal diseases on cole crops, ornamentals and turf. As a fungicide, quintozene interferes with mitotic division and suppresses fungal sporulation. Quintozene can be applied by professional applicators.

Health Considerations

Can Approved Uses of Quintozene Affect Human Health?

With the additional risk reduction measures required on quintozene labels, the remaining uses (cole crops and ornamental bulb dip) are unlikely to affect your health.

People could be exposed to quintozene by consuming food and water, working as a mixer/loader/applicator or by entering treated sites. The PMRA considers two key factors when assessing health risks: the levels at which no health effects occur and the levels to which people may be exposed. The dose levels used to assess risks are established to protect the most sensitive human population (for example, children and nursing mothers). Only uses, for which exposure is well below levels that cause no effects in animal testing, are considered acceptable for continued registration.

It was concluded that continued registration of certain uses of quintozene was unlikely to affect human health provided implementation of the required mitigation measures.

Maximum Residue Limits

The *Food and Drugs Act* prohibits the sale of food containing a pesticide residue that exceeds the established maximum residue limit (MRL). Pesticide MRLs are established for *Food and Drugs Act* purposes through the evaluation of scientific data under the *Pest Control Products Act*. Each MRL value defines the maximum concentration in parts per million (ppm) of a pesticide allowed in/on certain foods. Food containing a pesticide residue at the established MRL does not pose an unacceptable health risk.

Currently in Canada, quintozene is registered for use on cole crops. Quintozene could be used in other countries on crops that are imported into Canada. Where no specific MRL has been established, a default MRL of 0.1 ppm applies, which means that pesticide residues in a food commodity must not exceed 0.1 ppm. However, changes to this general MRL may be implemented in the future, as indicated in the Discussion Document DIS2006-01, *Revocation of the 0.1 ppm as a General Maximum Residue Limit for Food Pesticide Residues [Regulation B.15.002(1)]*. If and when the general MRL is revoked, a transition strategy will be established to allow permanent MRLs to be set.

Environmental Considerations

What Happens When Quintozene Is Introduced Into the Environment?

With the additional risk reduction measures required on quintozene labels, the remaining uses (cole crops and ornamental bulb dip) will not pose unacceptable risks to the environment.

Quintozene is persistent and has the potential to bioaccumulate in the environment. It has been detected in remote regions of Canada including the Arctic; therefore, it has sufficient persistence to be subjected to long-range transport.

Toxic Substance Management Policy Considerations

The PMRA has taken into account the federal Toxic Substance Management Policy (TSMP) during the review of quintozene.

Quintozene meets three of the four requirements for Track 1 status under the TSMP (soil and air): It is persistent, anthropogenic and toxic as defined by the *Canadian Environmental Protection Act*. The PMRA has concluded that quintozene does not meet the TSMP Track 1 criterion for bioaccumulation because there is insufficient laboratory evidence indicating that the criterion for bioaccumulation (BCF 5000) has been met.

Additional information provided by the registrant confirmed that quintozene is associated with Track 1 contaminants of concern as defined in the federal TSMP; namely, hexachlorobenzene, pentachlorobenzene, dioxins and furans. The phase-out of all turf and ornamental uses, except bulb dip, will result in a significant decrease in the release of these contaminants into the environment, consistent with the TSMP goal of virtual elimination.

Value Considerations

What is the Value of Quintozene?

The continued availability of products formulated with quintozene is critical to the ornamental industry for the control of bulb rots caused by *Sclerotinia* spp. and to the cole crop industry for the control of club root (*Plamodiophora brassicae*).

Following the re-evaluation announcement for quintozene, the registrant of the technical grade active ingredient in Canada indicated their intention to support all quintozene uses included on the labels of Commercial Class end-use products.

Quintozene (a group 14 fungicide) is registered for the control of club root in cole crops (broccoli, Brussels sprouts, cabbage and cauliflower) as a single application at transplant. Only one other active ingredient, fluazinam (a group 29 fungicide), is registered for the same use. Soil fumigants such as metam sodium and chloropicrin are available, but are limited to use prior to planting and will not control this organism on diseased seedlings. Although fungicides and soil fumigants are used, most growers rely on cultural methods such as sanitation, crop rotation and soil amendments with lime to manage the disease.

Quintozene is important for control of bulb rots caused by *Sclerotinia* spp. on ornamentals such as bulbous iris, crocus, hyacinth, mayflower, narcissus and tulips. Soil fumigants such as metam sodium and chloropicrin are available for control of *Sclerotinia* pathogens in the soil prior to planting, however, the only other viable alternative active ingredients registered for control of *Sclerotinia* pathogens present on the bulbs prior to planting are oxine benzoate and captan. The technical registrant for oxine benzoate does not support continued use of this active ingredient on ornamentals as a bulb dip treatment. All products currently registered containing oxine benzoate have been voluntarily discontinued by the registrants and will expire on December 31, 2011. Captan is currently under re-evaluation; furthermore it is registered for use only on iris, narcissus and tulips.

There are alternative active ingredients to quintozene currently registered for the control of stem rots caused by *Rhizoctonia* spp. and *Sclerotinia sclerotiorum*. For *Rhizoctonia* spp. these include thiophanate-methyl, iprodione, oxine benzoate, captan, folpet, *Bacillus subtilus* (a biological control agent), and soil fumigants: metam sodium and chloropicrin. Several of these active ingredients are currently under re-evaluation. Others have the following use limitations:

- All currently registered products containing oxine benzoate have been voluntarily discontinued by the registrants and are to expire on December 31, 2011;
- Captan is registered for use on azalea, chrysanthemum and carnation cuttings only.
- Folpet is registered for use on azalea cuttings only; and
- *Bacillus subtilis* is registered for suppression only and must be rotated with other registered fungicides.

Registered alternative active ingredients for control of stem rots caused by *Sclerotinia sclerotiorum* include captan, oxine benzoate and the soil fumigants.

Non-chemical control measures such as sanitation, quarantine and pasteurization of soil or planting media are also available to reduce the incidence and severity of stem rot pathogens in greenhouses, however, once the pathogen is established chemical control methods are then required. For outdoor ornamentals, only the use of soil fumigants is feasible for the control of stem rot pathogens that are present in the soil prior to planting.

Viable alternative active ingredients to quintozene are currently registered for control of turf diseases. These are discussed in the response to stakeholder comments in Table 1 in Appendix I.

Measures to Minimize Risk

Labels of registered pesticide products include specific instructions for use. Directions include risk-reduction measures to protect human and environmental health. These directions must be followed by law. As a result of the re-evaluation of quintozene, the following mitigation measures are required (See also Appendix III):

- Reduction of the maximum application rate on cole crops.
- Packaging the wettable powder formulation in water soluble packets.
- Phase-out of all turf uses, including residential, commercial, turf farms and golf courses.
- Phase-out of all ornamental uses except bulb dip treatment.
- Additional protective equipment to protect mixers/loaders/applicators.
- A restricted-entry interval to protect workers re-entering treated sites.
- Additional advisory label statements to protect non-target sensitive terrestrial and aquatic species.

What Additional Scientific Information Is Required?

Data to confirm current levels of impurities of health and environmental concern in technical grade quintozene are still required. These data have been requested from the registrant and are required under Section 12 of the *Pest Control Products Act*. The registrant of this active ingredient must provide these data (Appendix II) or an acceptable scientific rationale to the PMRA within the time line specified in the decision letter.

Other Information

Any person may file a notice of objection[3] regarding this decision on quintozene within 60 days from the date of publication of this Re-evaluation Decision. For more information regarding the basis for objecting (which must be based on scientific grounds), please refer to the PMRA's website (Request a Reconsideration of Decision, www.pmra-arla.gc.ca/english/pubreg/reconsideration-e.html), or contact the PMRA's Pest Management Information Service by phone (1-800-267-3615) or by e-mail (pmra.infoserv@hc-sc.gc.ca).

[3] As per subsection 35(1) of the *Pest Control Products Act*.

Appendix I Comments and Responses

1.0 Comments Pertaining to the Environmental Risk Assessment

In response to PRVD2009-02, comments regarding the environmental risk assessment were received from the registrant and the British Columbia Ministry of Agriculture and Lands.

1.1 Comments

Environmental Risk Assessment
The commentator indicated that risk assessment results using an older model (ELL-FATE) as well as a newer model (T-REX) were reported in the PRVD. While the T-REX model represents a refinement and improvement over the ELL-FATE model that the USEPA used for the quintozene RED, the T-REX model still includes significant limitations and assumptions that impact the output (results) of the model and which need to be recognized when discussing RQs calculated using the T-REX model.

Further the commentator indicates that incorrect US application rates were reported in the PRVD.

Golf Course Adjustment Factor
The Golf Course Adjustment Factor should be used to calculate Estimated Drinking Water Concentrations (EDWCs) and aquatic Estimated Environmental Concentration (EECs).

Use Pattern Changes
Following the publication of the PRVD, the Canadian registrant proposed to limit quintozene use on turf to golf course greens, tees, and fairways only. Also, it was indicated that terrestrial RQs for quintozene use on turf should be based on the post-mitigation TREX results not the pre-mitigation ELL-FATE results.

Risk to non-target species following application on cole crops
The commentator inquired as to the risk to mammals and birds following quintozene application on cole crops.

PMRA Response

Enironmental Risk Assessment
Quintozene has been re-evaluated under Re-evaluation Program 1. In accordance to Regulatory Directive DIR2001-03, *PMRA Re-evaluation Program*, quintozene re-evaluation relied as much as possible on the outcomes of the pesticide reregistration program of the US. On this basis, the results of the USEPA risk assessment, including assumptions and limitations of models used to assess the potential risks, are accepted by the PMRA.

The PMRA is aware that the TREX model is an improved version of the older ELL-FATE model. However, at the time of the PRVD document, the registrant supported all quintozene uses on turf including golf course and turf farm uses. The USEPA assessment outlined in the 2006

RED used the ELL-FATE model for the turf scenario. On this basis, the results of the USEPA risk assessment based on the ELL-FATE model for the turf scenario were included in the PRVD2009-02, *Quintozene*.

The PMRA acknowledges that the US application rates reported in the PRVD were inaccurate however this did not have any impact on the final conclusions as the risk for terrestrial mammals remains of concern.

Golf Course Adjustment Factor
According to the USEPA "*the GCAF is only applicable to golf course use scenarios, and cannot be used to modify estimated surface water concentrations associated with sod grass farm, residential, right-of-ways, (other) recreational or any other turf use*". Since at the time of the PRVD the Canadian registrant supported all turf uses of quintozene, such as residential lawns, turf farms and golf courses, the PMRA determined that the use of the GCAF was not justified.

Use Pattern Changes
The phase-out of all turf uses proposed by the PMRA is due to human health and environmental concerns. Following the publication of the PRVD, the Canadian registrant proposed to limit quintozene use on turf to golf course greens, tees, and fairways only. Quintozene is considered to have persistent, bioaccumulative and toxic characteristics with evidence of long range transport and the application rate (18.8 kg a.i./ha) used on turf is high. Further, additional information provided by the registrant confirmed that quintozene is associated with Track 1 contaminants of concern; namely, hexachlorobenzene, pentachlorobenzene, dioxins and furans, as defined in the federal TSMP. Consistent with the TSMP goal to prevent or minimize releases of Track 1 contaminants into the environment with the ultimate goal of virtual elimination, phase-out of uses resulting in the largest releases of these contaminants into the environment is required. These uses include all turf uses. A number of OECD countries including the European Union have also prohibited the use of quintozene.

Risk to non-target species following application on cole crops and turf
Exposure of non-target species to quintozene following application in the form of a transplant solution injected into soil at the time of planting is expected to be low.

2.0 Comments on Environmental Fate Characteristics

2.1 Comments

Quintozene vapour pressure
The PMRA indicates in the PRVD that quintozene is highly volatile. Given a low vapour pressure, equivalent to 9.53×10^{-5} mm Hg (torr; 1.25×10^{-7} atm), quintozene should not be described as having "high" volatility.

Quintozene phototransformation
Quintozene absorbs light in the solar UV range, is very reactive in water photolytically, and its photoproducts are consistent with reactions with species that occur in the atmosphere.

n-octanol-water partition coefficient (log K_{ow}) factor

A comment indicated that in the RED, the EPA stated that the log K_{ow} is 4.22 however in the PRVD, the PMRA used the value of 5.1.

PMRA Response

Quintozene vapour pressure
The measured vapour pressure of a chemical compound is a guide to its volatility and to the probability of its movement into the atmosphere. In general, pesticides with vapour pressures ≥ 3.9×10^{-5} mm Hg (5.20×10^{-3} Pa) are considered to be of intermediate to high volatility under field conditions (Kennedy and Talbert, 1977). Therefore, quintozene with a vapour pressure of 12.7 mPa (9.53×10^{-5} mm Hg), as reported in the PRVD based on information available in the e-Pesticide Manual, is considered of intermediate to high volatility.

Quintozene phototransformation
The PMRA characterisation of quintozene is based solely on the potential for direct photolysis as a result of absorbance in the solar UV range. Therefore, the statement in the PRVD should be changed to read: "low potential for direct photolysis". Phototransformation studies in aquatic media are required to address the potential for phototransformation mediated by processes other than direct photolysis.

n-octanol-water coefficient (log K_{ow}) factor
The log K_{ow} reported in the PRVD was based on information available in the e-Pesticide Manual. The PMRA acknowledges that different log K_{ow} values have been reported in the 2006 USEPA RED for quintozene, as well as in literature available in the public domain. Should the registrant wish to address this difference, a study would be required to be submitted: DACO 2.14.11 Octanol-Water Partition Coefficient.

3.0 Comments on Persistent, Bioaccumulative and Toxic Characteristics

3.1 Comments

Bioaccumulation potential of quintozene
One commentator indicated that there is insufficient evidence regarding the bioaccumulation potential of quintozene.

Long range transport
The amount of quintozene detected in air samples collected in western Canada is not indicative of a significant long range transport threat. The commentator also indicated that various other studies and reviews published on the subject of long range transport showed no detection of quintozene.

PMRA Response

Bioaccumulation potential of quintozene
Quintozene does not meet the TSMP Track 1 criterion for bioaccumulation because there is insufficient laboratory evidence indicating that the criterion for bioaccumulation (BCF 5000) has been met. However, quintozene is considered to have persistent, bioaccumulative and toxic

characteristics. The PMRA is currently developing a policy for managing such substances and quintozene may be revisited once an approach has been developed.

Long range transport
Quintozene has intermediate to high volatility (vapour pressure of 12.7 mPa at 25°C) and, the estimated photo-oxidation half-life for quintozene in the vapour phase is 2,200 days, thus, indicating a long-range transport potential. Further a publication by Daly *et. al*, (2007), showing detection of quintozene residues in mountains of western Canada, as well as another by Hoferkamp *et. al.* (2009 in press) reporting detections in the Arctic, are indicative of the long-range transport potential of quintozene. The PMRA makes no judgment as to the amount of quintozene detected in air samples.

4.0 Comments on Impurities of Health and Environmental Concern

4.1 Comment

The PRVD indicates the presence of several impurities of concern in quintozene and further states that additional information will be requested.

PMRA Response

To review the current levels of TSMP Track 1 contaminants such as hexachlorobenzene (HCB), dibenzo-p-dioxins (PCDDs) and polychlorinated dibenzofurans (PCDFs), as well as contaminants of concern specified in the amended List of Pest Control Product Formulants and Contaminants of Health or Environmental Concern (Canada Gazette, Part II, 2008-06-25), recent analytical data were requested by the PMRA under Section 19 of the PCPA.

Information provided by the registrant indicates that the level of dioxin-like substances in the Canadian technical grade active ingredient remains practically unchanged since the last analysis was conducted.

As noted in Appendix II, analyses of recent production batches of technical grade quintozene continue to be required for hexachlorobenzene, tetrachlorobenzene, pentachloroanaline, dimethylformamide and nitrosamines.

Hexachlorobenzene (HCB) levels in quintozene are significantly higher than in other pesticides. HCB is targeted in the PMRA implementation of TSMP as pesticides are the primary source of HCB in the Canadian environment. Pesticides are not the primary source of dioxins and other Track 1 substances in the Canadian environment.

The proposed approach in the PRVD to reduce the use pattern to only include two small critical uses for which limited alternatives are currently available in Canada (control of clubroot in cole crops and bulb rot in ornamental bulbs) would result in a significant reduction in environmental exposure and a reduction in input of Track-1 substances into the environment. It was concluded that this would be consistent with the TSMP goal of virtual elimination.

5.0 Comments Pertaining to Value

In response to PRVD2009-02, comments regarding the value of quintozene were received from various stakeholders. Over 200 letters were received from representatives of turf grass and golf associations.

5.1 Comments – Turf Uses

Efficacy performance:
Quintozene provides prolonged protection to turf from grey and pink snow moulds relative to the registered alternatives; repeat applications of alternative active ingredients would be required to provide a prolonged period of protection equivalent to that of one application of quintozene.

Economic impact of the loss of quintozene as a pest management tool:
Quintozene is a cost effective pest management tool for turf management. Its loss as a turf pest management tool will result in a greater damage to turf from snow moulds. Damage to turf from snow moulds will result in lost income as a direct result of:

- a reduced period of playability to greens and tees;
- additional turf maintenance costs; and
- an increase in pesticide expenditures: the registered alternative products to the quintozene products are more costly and will require more than one application.

Resistance management:
Quintozene is needed for rotation with registered alternative active ingredients with different Modes of Action (MoA) to delay the development of resistance. Most of the recently registered alternative active ingredients to quintozene have a single-site mode of action. Greater use of active ingredients with a single-site mode of action will increase the risk of developing resistance.

Need for contact fungicides on dormant turf:
Quintozene acts as a contact fungicide – this is critical for control of snow moulds as alternative systemic fungicides will be less effective since turf is dormant when these pests are active.

PMRA Response

Efficacy performance:
Alternative products to quintozene which provide season long control (such as, for the duration of winter) of snow moulds on turf with only one application are registered in Canada. These include two products formulated with iprodione (MoA group 2) being Rovral Green GT (Reg. No. 24379) and Quali Pro Iprodione (Reg. No. 29410) and one product formulated with three active ingredients, propiconazole, fludioxonil and chlorothalonil (MoA group 3, 12 and M5 respectively) being Instrata (Reg. No. 28861).

Economic impact of the loss of quintozene as a pest management tool:
The PMRA acknowledges that the registered alternative active ingredients to quintozene for the control of snow moulds on turf may be more costly. A list of alternative active ingredients registered for use on turf in Canada as of October 2009 is presented and their viability discussed in Table 1.

Resistance management:
Quintozene is a MoA group 14 fungicide which acts as a protective contact fungicide. Alternative active ingredients to quintozene registered for use in Canada to control snow moulds (grey and pink) on turf include MoA group 1 (pink snow mould only), 2, 3, 7, 11, 12, M3 and M5. Most alternative active ingredients to quintozene have a single-site mode of action; however, two alternative active ingredients (chlorothalonil and thiram) have multi-site modes of action. The registered single-site MoA active ingredients with a high risk of resistance development should be alternated with the registered multi-site MoA fungicides that have a low risk for resistance development in snow moulds.

Some alternative active ingredients to quintozene are registered for use as tank mixes with products from other MoA groups for resistance management and to increase efficacy, for example, chlorothalonil (group M5) and iprodione (group 2). Additionally, products formulated with several active ingredients from different MoA groups are also currently registered, for example, Instrata (Reg. No. 28861).

Need for contact fungicides on dormant turf:
Gray snow moulds pass the summer as dormant sclerotic that produce spores during cool (<10°C), wet conditions in the fall. Pink snow mould passes the summer as dormant mycelia. Pink snow mould spores are formed during growth in the fall and are distributed by water drainage. Fungal growth and infection of the turf by snow moulds take place under cool, wet conditions and in particular under the snow cover.

Contact fungicides with protective (and curative) action provide an advantage over systemic fungicides for the control of snow moulds since systemic fungicides will be less effective in dormant turf. Quintozene is a contact fungicide with protective action.

Alternative active ingredients to quintozene which act by contact action to control snow moulds on turf are registered in Canada. Iprodione is a contact fungicide with protective and curative action: it inhibits germination of spores and growth of fungal mycelia. Fludioxonil, chlorothalonil, and thiram are contact fungicides with protective action. Fudioxonil mainly inhibits germination of spores and to a lesser extent mycelial growth. Chlorothalonil inhibits growth of germinating fungal cells. Thiram has a multi-site mode of action.

Other alternative active ingredients to quintozene that have contact and systemic (translaminar) protective and curative action include azoxystrobin, pyraclostrobin and trifloxystrobin.

Table 1 Alternative active ingredients to quintozene for the control of pink and grey snow mould on turf registered in Canada as of October 5, 2009

Crop	Pest	Mode of Action[1]: Registered alternatives[2]	Comments
Turf	Pink snow mould (*Fusarium nivale*), grey snow mould (*Typhula spp.*)	1: thiophanate methyl	Thiophanate methyl is currently under re-evaluation as indicated in REV2007-10, and is registered for the control of pink snow mould only.
		2: iprodione	Iprodione is currently under re-evaluation as indicated in REV2009-07 *PMRA Re-evaluation Workplan (April 2009 to March 2010).* Iprodione has protectant and curative properties. It inhibits germination of spores and growth of mycelium. Application is required in the fall and spring when the snow melts. Rovral Green GT (Reg. No. 24379) and Quali-pro Iprodione (Reg. No. 29410) are the only iprodione products registered for a single application prior to snow cover for season long control.
		3: myclobutanil, propiconazole, triticonazole	Myclobutanil and propiconazole are currently under re-evaluation as indicated in REV2009-07. Myclobutanil and propiconazole are systemic fungicides with protective and curative properties. Myclobutanil is not registered for control of pink snow mould. Triticonazole has protective properties. Triticonazole requires repeated applications to control grey snow mould and is registered as a tank mix with Rovral Green GT (Reg. No. 24379) for control of pink snow mould.
		3/12/M5: propiconazole/ fludioxonil/ chlorothalonil	Chlorothalonil and propiconazole are currently under re-evaluation as indicated in REV2009-07. Only one product is registered in Canada with this combination of active ingredients, Instrata (Reg. No. 28861). The product label recommends that turf treated in the previous season with Instrata not be treated in the following season. Fludixonil is a protectant, non-systemic fungicide with long residual activity. Propiconazole has protectant and curative properties. Chlorothalonil has protectant properties for snow moulds.
		7/M3: carbathiin/ oxycaboxin/thiram	Thiram is under re-evaluation as indicated in REV2009-07. Carbathiin and oxycarboxin are currently under re-evaluation as indicated in REV2007-10 *PMRA Re-evaluation Workplan (April 2007 to March 2008).* As indicated in PRVD2008-25 *Carbathiin and Oxycarboxin*, the registrant for the technical grade active ingredients does not support the continued use of carbathiin and oxycarboxin on turf. Thiram is a protective contact fungicide.
		11: azoxystrobin, pyraclostrobin, trifloxystrobin	Azoxystrobin, pyraclostrobin and trifloxystrobin have protective and curative properties. The mode of action is by inhibition of mitochondrial respiration. Trifloxystrobin is registered as a tank mix with iprodione (Rovral Green GT Reg. No. 24379) and is not recommended for greens and tees.
		M5: chlorothalonil	Chlorothalonil is currently under re-evaluation as indicated in REV2009-07. Chlorothalonil has protective properties for snow moulds. It is not recommended for curative application.

[1] *Fungicide Resistance Management Group Numbers based on DIR 99-06 Voluntary Pesticide Resistance Management Labelling based on Target Site/Mode of Action*, with updates from the Fungicide Resistance Action Committee (FRAC) www.frac.info/:
1 = inhibition of tubulin formation; 2 = inhibition of osmotic signal transduction (MAP / histidine kinase os-1, Daf1); 3 = demethylation inhibitor (DMI) (inhibition of demethylation in sterol biosynthesis); 7 = inhibition of respiration (succinate dehydrogenase inhibitors); 11 = strobilurin type action and resistance (STAR) inhibit mitochondrial respiration; 12 = phenylpyrroles osmotic signal transduction (MAP / histidine kinase os-2, HOG1); M3 = multi-site activity (dithiocarbamates & relatives); M5 = multi-site activity (chloronitriles).

[2] This is a list of alternative active ingredients registered in Canada as of October 5, 2009. Health Canada does not endorse any of the options listed. The registration status of active ingredients under re-evaluation may change pending the final regulatory decision. For additional information, consult the PMRA publications website: www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/index-eng.php#rvd-drv (English) and www.hc-sc.gc.ca/cps-spc/pubs/pest/_decisions/index-fra.php (French) for Re-evaluation decisions (RVD and RRD documents) and Re-evaluation notes (REV documents) or www.hc-sc.gc.ca/cps-spc/pest/part/consultations/index-eng.php (English) and www.hc-sc.gc.ca/cps-spc/pest/part/consultations/index-fra.php (French) for current and past consultation documents including Proposed Re-evaluation Decisions (PRVD and PACR documents) and certain Re-evaluation notes (REV documents).

Appendix II Data Requirements for Quintozene

The following data are required under Section 12 of the *Pest Control Products Act*.

DACO 2.11.3 Detailed Production Process Description

The registrant is required to confirm that the current manufacturing process is the same as the previously reported process and/or provide the details of the current manufacturing process.

DACO 2.13.4 Impurities of Human Health or Environmental Concern

Recent analytical data from at least five batches of the technical must be provided for hexachlorobenzene, tetrachlorobenzene, pentachloroaniline, and dimethylformamide. The data must be generated according to the principles of Good Laboratory Practice (GLP).

Data for volatile nitrosamines must also be provided if they are formed in the manufacturing process or subsequent purification steps. If they cannot be formed in this process, a detailed scientific waiver may be accepted based on the production process.

Appendix III Label Amendments for Products Containing Quintozene

The label amendments presented below do not include all label requirements for individual end-use products, such as first aid statements, disposal statements, precautionary statements and supplementary protective equipment. Additional information on labels of currently registered products should not be removed unless it contradicts the label statements below.

The labels of end-use products in Canada must be amended to include the following statements to further protect workers and the environment.

I) The following uses are not eligible for continued registration and must be removed from end-use product labels:
- all turf uses including residential and commercial lawns, turf farms, golf courses;
- ornamental uses, with the exception of bulb dip treatment.

II) The end-use product label must be amended to indicate a maximum application rate on cole crops, as a transplant solution, of 1.1 g a.i./plant, as follows.

Use 1–1.5 kg of product per 400 L of water, apply maximum of 400 mL per plant for cole crop transplant solution application.

III) The following statements must be included in a section entitled **STORAGE**.

Store in cool, dry, well-ventilated place.

IV) The following statements must be included in a section entitled **PRECAUTIONS**.

A long-sleeved shirt and long pants, shoes plus socks and chemical-resistant gloves must be worn when handling the product. In addition, a chemical-resistant apron and NIOSH-approved respirator are required for workers involved in bulb soaking applications.

Do not enter or allow workers entry into treated areas for 12 hours following application.

V) The following statements must be included in a section entitled **ENVIRONMENTAL HAZARDS.**

Toxic to aquatic organisms, birds and small wild mammals.

To reduce runoff from treated areas into aquatic habitats avoid application to areas with a moderate to steep slope, compacted soil, or clay.

Contamination of aquatic areas as a result of runoff may be reduced by including a vegetative strip between the treated area and the edge of the water body.

Avoid application when heavy rain is forecast.

To minimize the release of quintozene into the environment due to volatilization, quintozene should only be applied on cool mornings and evenings when air temperatures are 15°C or lower. To further reduce volatilization to the atmosphere, incorporation into the soil should occur concurrently with application.

DO NOT apply this product directly to freshwater habitats (such as lakes, rivers, sloughs, ponds, prairie potholes, creeks, marshes, streams, reservoirs and wetlands), estuarine/marine habitats.

VI) The following statements must be included in the section entitled **DIRECTIONS FOR USE.**

DO NOT contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes.

VII) Wettable powder products must be packaged into water soluble packaging. For the replacement products packaged in water soluble bags, the following aspects must be considered when revising the label:

Dilution rates must be adjusted to accommodate product volume in bags.
Label must include a component for the water soluble bag.

The following statements must be included in a section entitled **DIRECTIONS FOR USE**.

Product X is a dry powder sealed within a water soluble bag. Drop an intact water soluble bag directly into a mixing tank. The water soluble bag and pesticide will dissolve readily in water.

Do not allow the water soluble bag to become wet prior to use. Do not remove a water soluble bag from an overwrap container except for immediate use.

Do not open or puncture a water soluble bag for any reason.

If a broken water soluble bag is found when the overwrap bag is opened, avoid contact with, and inhalation of the product.

The following statements must be included in a section entitled **STORAGE**.

Do not remove the pouch from an overwrap container except for immediate use. Do not allow to become wet in storage. Keep the container closed when not in use.

References

Studies Considered in the Chemistry Assessment – Submitted by Registrant

PMRA Document Number: 1480195
Reference: Specifications and Analytical Methodology for Pentachloronitrobenzene (PCNB). Vol. 3 QTZ-AMV-1, DACO: 2.1, 2.10, 2.14, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9; DACO 2.14

PMRA Document Number: 1480169
Reference: TGAI Chemistry. QTZ-AMV-1, DACO: 2.99; DACO 2.14, DACO 2.11

PMRA Document Number: 1480199
Reference: 1993, Specifications and Analytical Methodologies for Pentachloronitrobenzene (PCNB). Supplemental Data in Response to Letter of March 24, 1993, DACO: 2.13.3

PMRA Document Number: 1480183
Reference: Specifications and Analytical Methodology for Pentachloronitrobenzene (PCNB). Vol. 4 QTZ-AMV-1, DACO: 2.11.1, 2.11.2, 2.12, 2.13.1, 2.13.4

PMRA Document Number: 1480198
Reference: 1992, Specifications and Analytical Methodologies for Pentachloronitrobenzene (PCNB). Supplemental Data in Response to Letter of April 28, 1992, DACO: 2.13.4

PMRA Document Number: 1480201
Reference: 2002, Response to Clarification Notice: Quintozene 75 WP (Sub. # 1996-0190). Response to Your Clarification Notice Dated November 28, 2002, DACO: 2.13.4

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Daly G., Lei Y.D., Teixeira C., Muir D.C.G., Wania F. (2007) Pesticides in Western Canadian Mountain Air and Soil. *Environ. Sci. Technol.* 41: 6020-6025.

Hoferkamp L., Hermanson M.H., Muir D.C.G. (2009) Current use pesticides in Arctic media; 2000-2007. Sci. Total Environ. (in press)

Kennedy, J.M. and R.E. Talbert (1977) Comparative persistence of dinitroaniline type herbicides on the soil surface. *Weed Science*. 25(5): 373-381.